TENNESSEE DEPARTMENT OF EDUCATION
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Fire Science II

Primary Career Cluster:	Law, Public Safety, Corrections and Security
Consultant:	Sheila Carlton, (615) 532-2839, Sheila.Carlton@tn.gov
Course Code(s):	TBD
Prerequisite(s):	*Fire Science I* (required)
Credit:	1
Grade Level:	12
Graduation Requirements:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Law and Public Safety courses.
Programs of Study and Sequence:	This is the fourth course in the *Fire Management Services* program of study.
Necessary Equipment:	See equipment list on the Law and Public safety website, listed below.
Aligned Student Organization(s):	SkillsUSA: http://www.tnskillsusa.org Brandon Hudson, (615) 532-2804, Brandon.Hudson@tn.gov
Coordinating Work-Based Learning:	If a teacher has completed work-based learning training, he or she can offer appropriate student placement. For more information, please visit http://www.tn.gov/education/cte/wb/.
Available Student Industry Certifications:	None
Dual Credit or Dual Enrollment Opportunities:	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
Teacher Endorsement(s):	751
Required Teacher Certifications/Training:	Tennessee Fire Commission Fire Fighter Instructor 1
Teacher Resources:	http://www.tn.gov/education/cte/LawPublicSafetyCorrectionsSecurity.shtml

Course Description

Fire Science II is the fourth and final course in the Fire Management Services program of study. Students in this course continue to acquire the skills and knowledge needed to pursue a career as a Firefighter I. Those students who complete this course will be prepared, after graduation, to further their instruction at a training facility. Upon completion of this course, students will be able to correctly demonstrate skills

associated with ventilation, water supply, fire hose and fire streams in a non-live fire situation, and safety with hazardous materials. In order to qualify to teach *Fire Science II*, teachers must hold the Firefighter Instructor endorsement and incorporate the National Fire Protection Association (NFPA) standards and codes into the course. Standards in this course are aligned with Tennessee Common Core State Standards for English Language Arts & Literacy in Technical Subjects and NFPA standards.*

Program of Study Application

This is the fourth course in the *Fire Management Services* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Law, Public Safety, Corrections and Security website at http://www.tn.gov/education/cte/LawPublicSafetyCorrectionsSecurity.shtml.

Course Standards

Ventilation

1) Define the term ventilation as used in fire service; discuss reasons for fire-ground ventilation, principles of ventilation, considerations that affect the decision to ventilate, and challenges to ventilation in modern buildings. Review scenarios (including graphics) surrounding each and identify strategies to improve ventilation. (TN CCSS Reading 2, 4, 7; TN CCSS Writing 8, 9)

2) Explain theories surrounding vertical ventilation and the related safety precautions. Discuss warning signs of unsafe roof conditions, roof coverings, roof openings, and factors that reduce effectiveness when implementing vertical ventilation. Compare these findings to the same parameters associated with basement ventilation. (TN CCSS Reading 2, 4, 6; TN CCSS Writing 9)

3) Compare and contrast the ventilation techniques associated with various types of roofs, including flat, pitched, arched, concrete, and metal roofs. Clarify the differences between a trench ventilation maneuver and a strip ventilation maneuver. (TN CCSS Reading 1, 2, 4, 9; TN CCSS Writing 8, 9)

4) Infer from research the concepts surrounding horizontal ventilation, considerations for use, weather conditions that should be considered, internal and external exposures, and precautions against setting horizontal ventilation. Develop an informational essay sharing this information with other firefighter recruits. (TN CCSS Reading 1, 2, 4, 6; TN CCSS Writing 2, 4, 8, 9)

5) Argue the advantages and disadvantages of forced and hydraulic ventilation using positive-pressure or negative-pressure ventilation in a building filled with flammable or toxic gas that must be ventilated quickly and safely. (TN CCSS Reading 4, 9; TN CCSS Writing 1, 8)

Water Supply, Fire Hose, and Fire Streams

6) The use of water is an important factor in firefighting. Explain the components of water supply systems and how they can affect the success of putting out a fire, with emphasis on researching alternative, rural, and volunteer water supplies. (TN CCSS Reading 2, 3, 4; TN CCSS Writing 8, 9)

7) Compare and contrast the two types of fire hydrants, discussing the designs, purpose, operating principles, markings, locations, and testing procedures. Perform the skills of cleaning and inspecting fire hydrants and deploy a portable water tank. (TN CCSS Reading 4, 9)

8) Illustrate visually or graphically the primary aspects of fire hoses, including their construction, descriptions, sizes, and types of couplings. Perform the following Firefighter I skills:
    a. Make a straight hose roll
    b. Make a donut hose roll
    c. Couple a hose - foot-tilt method
    d. Couple a hose - two-firefighter method
    e. Uncouple a hose - knee-press method
    f. Uncouple a hose - two-firefighter method

    (TN CCSS Reading 3, 4, 8; TN CCSS Writing 6, 9)

9) Evaluate the NFPA 1961 *Standards on Fire Hose* concerning damage prevention, care for, and maintenance of a fire hose, as well as NFPA 1963 *Standard for Fire Hose Connections* for care of fire hose coupling. Inspect and clean a fire hose and its connections with 100% accuracy. (TN CCSS Reading 3, 4, 8; TN CCSS Writing 9)

10) Attach one end of a fire hose to a source of water and the other to a sprinkler. While performing the process, identify and explain the functions of the most common hose appliances and tools, as well as the types of hose rolls. (TN CCSS Reading 3, 4)

11) Interpret concepts related to hose loads and finishes, preconnected hose loads, and supply hose lays. Perform the following skills related to these concepts:
    a. Make the accordion hose load
    b. Make the horseshoe hose load
    c. Make the flat hose load
    d. Make the preconnected flat hose load
    e. Make the triple layer hose load
    f. Make the minuteman hose load
    g. Connect to a hydrant using a forward lay
    h. Make the reverse hose lay

    (TN CCSS Reading 3, 4)

12) Describe procedures for and safety measures related to handling, advancing, and operating a hoseline in a visual, oral, or graphic presentation. Cite information from textbooks, professional journals, or the NFPA website in the explanation. Perform the following skills with 100% accuracy:
    a. Advance the preconnected flat hose load
    b. Advance the minuteman hose load
    c. Advance the triple layer hose load
    d. Advance hose - shoulder-load method
    e. Advance hose - working line drag method
    f. Advance a line into a structure
    g. Advance a line up and down an interior stairway
    h. Advance an uncharged line up a ladder into a window

i. Extend a hoseline
j. Replace a burst hoseline

(TN CCSS Reading 2, 3, 4, 5, 8; TN CCSS Writing 6, 8, 9)

13) Research the principles of fire streams and explain the physical and chemical effects, extinguishing properties, and characteristics of water on a fire. (TN CCSS Reading 1, 2, 4; TN CCSS Writing 9)

14) Compare and contrast the types of fire stream patterns. Discuss advantages and disadvantages of each, examine the flow rate or pressure, determine if there is a need for water flow adjustment, observe pressure loss or gain, and demonstrate how to prevent a water hammer from occurring. Perform the following related skills:
    a. Operate a solid-stream nozzle
    b. Operate a fog stream nozzle: straight, narrow fog stream, and wide fog stream
    c. Operate a broken-stream nozzle

    (TN CCSS Reading 3, 4, 9; TN CCSS Writing 2, 7)

15) Distinguish between the solid-stream nozzle and the fog stream nozzle and the valves that are found in each. Develop a plan for care and maintenance of nozzles. (TN CCSS Reading 1, 3, 4; TN CCSS Writing 4, 8, 9)

Salvage, Overhaul, and Cause

16) Examine the procedures surrounding an overhaul operation, including potential threats to firefighters, safety measures to be followed, strategies for locating hidden fires, and tools used during an overhaul. Develop a standard of practice that every firefighter must follow surrounding overhaul procedures. (TN CCSS Reading 2, 3, 4, 5, 8; TN CCSS Writing 7, 8, 9)

17) Understand the following concepts of and perform skills related to salvage and loss control of a structure:
    a. Clean, inspect, and repair a salvage cover
    b. Roll a salvage cover for a one-firefighter spread
    c. Spread rolled salvage cover - one-firefighter method
    d. Fold a salvage cover for a one-firefighter spread
    e. Roll a salvage cover for a two-firefighter spread
    f. Spread a folded salvage cover for a two-firefighter balloon throw
    g. Construct a water chute without pike poles
    h. Construct a water chute with pike poles
    i. Construct a catchall

    (TN CCSS Reading 3, 4)

Hazardous Materials

18) Summarize the Awareness-Level and Operations-Level responsibilities surrounding hazardous materials and describe the type of personal protective equipment (PPE) that should be utilized during each. Demonstrate the skills of donning and doffing appropriate PPE. (TN CCSS Reading 3, 4; TN CCSS Writing 2)

19) Identify the respiratory protection that is required at a hazardous scene where chemical, biological, or radioactive materials are present. Identify the agencies that provide safety guidelines and limitations for each type of respiratory protection. (TN CCSS Reading 2, 8, 9; TN CCSS Writing 8, 9)

20) Compare and contrast the types of protective clothing that are worn at a structural fire, a high temperature setting, and a chemical hazard. Include PPE ensembles required by U.S. EPA levels of protection, the NFPA 1194 PPE ensemble classifications, and the Mission-Oriented Protective Posture. (TN CCSS Reading 4, 9; TN CCSS Writing 7, 8)

21) Safety at the scene is the number one concern for emergency responders; Hazmat situations increase the potential for health hazards. Explain the following types of hazards, strategies for identifying the hazard, the required PPE, health implications, and follow-up care.
    a. Thermal
    b. Radiological
    c. Asphyxiation
    d. Chemical
    e. Etiological/Biological
    f. Mechanical
    g. Illicit laboratories

    (TN CCSS Reading 2, 4; TN CCSS Writing 9)

22) Research the potential outcomes associated with hazardous material incidents as determined by their properties and behavior, such as physical state, vapor pressure, boiling point, vapor density, solubility, specific gravity, persistence, and reactivity. (TN CCSS Reading 2, 4, 8; TN CCSS Writing 8, 9)

23) Compare and contrast different types of container shapes for bulk and non-bulk packaging. Incorporate descriptions of tank or storage type, contents that might be found in the container, and placards that might be found on each container. (TN CCSS Reading 4, 9; TN CCSS Writing 9)

24) Explain the difference in the regulation of hazardous material transportation between the U.S. Department of Transportation (USDOT), Transport Canada (TC), Ministry of Communications and Transportation of Mexico, and the United Nations (UN). Identify placards, labels, and markings from each of these areas as well as other markings and colors commonly found on containers. Perform skills to obtain information about a hazardous material using the USDOT's Emergency Response Guidebook (ERG):
    a. Using the U.N. Identification Number
    b. Using the material name
    c. Using the container profile
    d. Using the placard

    (TN CCSS Reading 2, 4, 6; TN CCSS Writing 8, 9)

Operations at a Hazmat Incident

Skills related to Hazmat operations will be performed at a training center after student has graduated.

25) Create a mock scenario surrounding potential involvement with hazardous materials. Within the scenario, outline the incident priorities, management structure or jurisdiction, and incident

mitigation protocols such as analyzing the situation, planning the appropriate response, implementing the incident action plan, and evaluating progress. (TN CCSS Reading 1, 2, 4, 6, 7; TN CCSS Writing 2, 8, 9)

26) Identify the strategic goals and tactical objects of incidents related to a hazardous situation, including but not limited to the following components:
    a. Isolation and scene control
    b. Notification
    c. Identification
    d. Protection of responders and the public
    e. Decontamination
    f. Rescue
    g. Spill control and leak contamination
    h. Fire control
    i. Crime scene management and evidence preservation
    j. Recovery and termination

    (TN CCSS Reading 2, 4, 6; TN CCSS Writing 8, 9)

Rescue and Extrication

27) Develop a mock scenario in which a search and rescue would be performed in a burning structure. Outline search and safety guidelines for both victims and firefighters, procedures for obtaining information about persons in the building, the process for conducting a primary and a secondary search, and victim removal methods. Describe search methods for each room of a building and employ standard marking systems. Demonstrate the skill of exiting a hazardous area. (TN CCSS Reading 3, 4, 6, 8; TN CCSS Writing 2, 8, 9)

28) Evaluate research on the topic of firefighters becoming disoriented, lost, or trapped in a burning building in order to identify possible preventive measures or strategies. Cite effective rapid intervention strategies to rescue a firefighter in trouble. (TN CCSS Reading 2, 4, 8; TN CCSS Writing 2, 8, 9)

29) Follow precisely a complex multistep procedure when performing skills in a rescue situation, such as:
    a. Incline drag
    b. Webbing drag
    c. Cradle-in-arms lift/carry-one-rescuer method
    d. Cradle-in-arms lift/carry-two-rescuer method
    e. Chair lift/carry method - two rescuers

    (TN CCSS Reading 3, 4)

Standards Alignment Notes

*References to other standards include:

- TN CCSS Reading: Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects; Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
    - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN CCSS Writing: Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects; Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
    - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3, 5 and 10 at the conclusion of the course.
- P21: Partnership for 21st Century Skills Framework for 21st Century Learning
    - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.
- National Fire Protection Association (NFPA) Fire Fighter Professional Qualifications